A Comparison of Different Computer Vision Methods and Algorithms for the Classification of Aquatic Macroinvertebrates

[*]A Computer Vision project for the Department of Engineering at Aarhus University

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***Abstract*—Measuring water quality in natural environments can be a difficult problem to tackle. One of the ways of assessing the quality of fresh water in such environment is to observe and analyse the different aquatic macroinvertebrates that live in it. Using modern Computer Vision methods to do so is inherently more efficient, in terms of time and cost, than relying on the sole human expertise. Developing proper techniques in order to achieve similar, if not better, results than manual observation and analysis is the ultimate goal of this research. In this paper, a subset of the original dataset is used to conduct independent research on different image classification algorithms, and to compare several common ones with the state of the art Convolutional Neural Networks.**

***Index Terms*—CNN, Deep Neural Network, image classification, computer vision, machine learning**

I. Introduction

Ensuring the quality of water sources is an important task for the good of a human population, as well as the one of its surrounding ecosystem. Water can be infected with all sorts of bacteria, but can also contain a significant amount of micro-organisms that wouldn't be suited for human consumption, but nevertheless being part of a natural aquatic ecosystem that could be seen as a gage of quality and sanity.

INSERT IMAGE OF MACROINVERTEBRATES HERE

However, measuring such concept isn't as trivial as what is commonly done with regular metrics, and it requires more reasoning and analysing than most standard measures in the scientific domain do. This study focuses on the analysis of known aquatic macroinvertebrates, which are part of aquatic ecosystems in water sources, and their automated classification using a machine learning approach. The end goal is to provide a reliable method for this task, that would ultimately surpass the human expertise in the field. In this paper, a set of well known and commonly used machine learning and computer vision methods are presented, and their results are compared and discussed after application on the dataset; the famous state-of-the-art Convolutional Neural Network will be used as a reference point in the benchmark.

II. Dataset

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Number equations consecutively. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

$$a + b = \gamma \tag{1}$$

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An excellent style manual for science writers is [7].

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TABLE I
TABLE TYPE STYLES

Table Head	**Table Column Head**		
	Table column subhead	***Subhead***	***Subhead***
copy	More table copy[a]		

[a]Sample of a Table footnote.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization", or "Magnetization, M", not just "M". If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" or "Magnetization {A[m(1)]}", not just "A/m". Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)", not "Temperature/K".

Fig. 1. Example of a figure caption.

ACKNOWLEDGMENT

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